be of great value in the Army and Navy, as reflectors for search-lights, where the breaking of the mirror in time of action might have very serious results.

In this article it has only been possible to touch the margin of the electro-chemical industry, and only, with the exception of calcium carbide, such processes as deal with electro-metallurgy and electrolytical deposition have been dwelt upon. It is hoped in another article to draw attention to the production of non-metallic elements, and to the manufacture of chemical products both inorganic and organic. F. MOLLWO PERKIN.

THE PROBLEM OF COALING AT SEA.

WAR, at the present time, brings home to us the necessity of considering "Energy," its different forms, and their practical application. In these days, when the machinery of a battleship not only propels the vessel, but lights, ventilates, and controls the working of the heavy guns, it may be said that the ship is primarily dependent on one source of energy—Coal. A vessel short of this requisite has hitherto been compelled to fall out of line and be thus useless until she has "coaled ship," which in many cases entails several miles steaming, delay, and perhaps lost opportunities.

On this account any efficient mechanical contrivance for overcoming the difficulty of obviating the ship putting into port and enabling a full recharge of energy while cruising to be possible must be looked upon by all with interest.

In the *Engineering Magazine* for February is an illustrated account of a series of trials made in the United States Navy with the "Miller Conveyor" for coaling at sea, and the method may be briefly described as follows:—

The battleship to be coaled tows the collier, from which it takes the coal in loads of 840 lbs. by means of an overhead cable and suspended carriage. During the experiments two points of interest presented themselves: (1) The proper distance between the ships; (2) The way of overcoming the variation required in the length of ropes caused by the rolling and pitching. With regard to the first point it was found that with 300 feet between the ships, the collier would not follow properly, but during the rough weather trial with about 400 feet between the ships, the collier followed perfectly.

The second point caused the chief difficulty, and in Mr. Miller's design we find the length of overhead cables made variable, as required partly by the movement of the ships themselves, and partly by the power engine on deck. In the following table will be found information and data of the five trials made:—

Trial Number	Speed	Number of loads (840 lbs.) or tons trans-shipped	Remarks
First	5 to 6 knots	9 loads only	Adjustments made
Second		14 tons 5 cwt. in 38m. 40s.	Work stopped through lack of skill on part of operator
Third		22 tons in one hour	Work could have continued but for lack of sufficient crew to fill the bags
		Between the third and	fourth slight alterations made
Fourth		75 tons in 3h. 43m.	Trial lasted four hours; water smooth, ground swell
Fifth		80 trips made in 80m., or 30 tons in 1h. 20m.	Could have continued indefinitely. Board of Judges satisfied. Water rough.

As we are informed that the battleship consumed about $3\frac{1}{2}$ tons of coal per hour, the actual (or rather "paying") rate of coaling obtained was sixteen or seventeen tons.

The behaviour of the apparatus in rough weather was satisfactory, and the author writes, "The boats steered at first head on to the sea, the forecastle of the battleship *Massachusetts* was washed at every plunge, and no coal could have been delivered there, even if desired. The course was then changed quartering on the sea; the results were the same. Then the boats steered in the trough of the sea, and the rolling did not affect the working."

The article, which is illustrated with ten good photographs and a diagram, is certainly worthy of note, and deals with a subject which it is possible will revolutionise naval warfare in the near future.

MERCURY AS A NAKED EYE OBJECT.

RARELY visible, and always difficult to observe satisfactorily in a telescope, this planet is yet a most attractive object to the unaided eye. Not receding to a greater distance than 28° from the sun, he is, however, never above the horizon in England for a longer period than two and a quarter hours before sunrise, or for a similar interval after sunset. When an evening star in the spring months or a morning star in the autumn season, he may often be caught and watched for an hour or so, shining with a sparkling, rosy lustre, and presenting much the same aspect as a fixed star.

To secure a view of Mercury forms one of the earliest and greatest ambitions of the amateur astronomer. Among his first books there will sure to be a copy of Mitchell's "Orbs of Heaven," or Dicks's "Celestial Scenery," and on reading the statement that Copernicus never succeeded in seeing Mercury, he resolves that he will do his best to catch a glimpse of this elusive little "Messenger of the Gods." After some vain attempts he finally succeeds, and it is not too much to say that the spectacle sometimes excites and gratifies the observer more than any other subsequent event in his astronomical career. Who is there among us who does not remember the thrill of pleasure incited by the first detection of this fugitive orb, and the conscious pride with which we realised that we had commenced our celestial work by achieving a feat which had been denied to the greatest astronomer of the sixteenth century?

But, as a matter of fact, there seems to be considerable doubt whether Copernicus ever really complained of failure to see Mercury. There is evidence to show that he never expressed himself in the manner quoted in many of our popular text-books. There may, it is true, have been some ground for the statement, but it is well known that a biographer has only to introduce a special incident of the kind alluded to, or to unduly colour some expression, and whether on doubtful evidence or not, it is liable to be copied and recopied by subsequent writers without any investigation until it becomes generally accepted as a fact. But admitting for the moment that Copernicus really failed to discern Mercury, he seems to have had very good reason for it. His residence was at Thorn, in Prussia, and through the valley near ran the River Vistula, over which were frequent fogs which obliterated objects near the horizon.

This tradition about Copernicus and Mercury has certainly, however, enhanced the interest with which the planet is regarded as a naked eye object. The beautiful white lustre of Venus—incomparably brighter than the aspect of Mercury—the stronger and steadier, yellowish light of Jupiter, or the conspicuous ruddy hue of Mars may present a more striking appearance in the sky than the twilight-veiled splendour of Mercury, but there is something about the sparkling lustre of the latter orb, hovering fugitively on the brow of the horizon, which forms an attraction peculiarly its own.

The best time to observe the planet in 1900 will be during the first eleven days of March, when his times of setting will be as follows:—

	h. m.		h. m.
March 1 ...	7 10	March 7 ...	7 36
2 ...	7 16	8 ...	7 39
3 ...	7 21	9 ...	7 41
4 ...	7 25	10 ...	7 41
5 ...	7 29	11 ...	7 41
6 ...	7 33		

During this period Venus will be a very brilliant object, situated about 21 degrees E.N.E. of Mercury. The greatest elongation of the latter (18° 16′ E.) will occur at 11 a.m. on March 8, on which day he sets about 1h. 50m. after the sun. If the western sky is clear on March 2 at about 6 p.m. an exceptionally good opportunity will occur for detecting the planet, for he

will be in conjunction with the crescent of the new moon at that time, and about 4½ degrees south.

On reference to my note-book I find that I obtained naked eye views of Mercury on 102 occasions between February 1868 and December 1899. But the planet was very rarely looked for here at the morning apparitions, and not always at really favourable spring elongations. If an observer with good sight made it a point to secure as many unassisted eye observations of this object as possible, he might be successful on about twelve occasions in a year. In a finer climate than ours, the planet may, of course, be more frequently seen. I think that some disappointments in regard to finding Mercury are due to the fact that observers scan the heavens at or after the time of maximum eastern elongations, instead of during a week or more preceding them. The phase and apparent brilliancy decrease rapidly at these periods. I have occasionally noticed Mercury as a very brilliant object about ten or twelve evenings before his greatest elongation, while at the date of his elongation he has appeared quite faint, and a few evenings later, become practically invisible, though above the horizon for about two hours after sunset.

My observations in various years have led me to the following conclusions regarding the visibility of the planet at the evening apparitions :—

(1) The greatest brightness of the planet is attained ten or twelve days prior to his greatest elongation.

(2) In February and March the planet may sometimes be caught twenty minutes after sunset, in April thirty minutes after sunset, and in May forty minutes after sunset. The stronger twilight towards midsummer occasions the difference.

(3) The duration of his visibility to the naked eye is about 1h. 40m. in March, 1h. 30m. in April, and 1h. 20m. in May. On a very exceptional occasion it is possible these limits may be exceeded.

(4) The planet is a conspicuous object, and certainly much brighter than a 1st mag. star. In February 1868 I considered that his lustre vied with that of Jupiter, then only 2° or 3° distant. In November 1882 he appeared brighter than Sirius. In 1876 he looked more striking than Mars, then 13° distant, but the latter planet was faint and at a considerable distance from the earth.

The greatest number of naked eye observations of Mercury at the same elongation was obtained at Bristol in the spring of 1876, when the planet was seen on thirteen different evenings. When Venus is near Mercury at a favourable time, she affords an excellent guide to the identification of the latter. But errors have often been induced, and either Venus or Jupiter has been mistaken for Mercury on many occasions. In April 1898 Venus was near Mercury, and some people, including a few regular astronomical observers, readily saw Venus and believed (and still ardently believe) that they were looking at Mercury.

The albedo, or reflecting capacity of the planet, is rated exceedingly low, being only 0·11, whereas Mars is 0·27, Saturn 0·50, and Venus and Jupiter 0·62. This is remarkable when we consider the occasional striking brightness of the small planet in a region of the sky full of strong twilight. By telescopic comparisons of the disc of Mercury with other planets, it is, however, easily seen that the former is relatively feeble in brilliancy. On May 12, 1890, I viewed Mercury and Venus in the same field of view of a 10-inch reflector, and remarked that the brilliant silvery light of Venus contrasted strongly with the much duller hue of Mercury. The probability is that the latter object is provided with a much thinner atmosphere than that which envelops his sister planet. There are undoubted markings visible on Mercury, but they are nothing like the peculiar representations of them which have been published in the last few years. The extreme difficulty of obtaining satisfactory views of the planet furnishes the principal reason why his rotation period still awaits accurate determination.

W. F. DENNING.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—Junior Scientific Club, February 21.—Mr. H. B. Hartley (Balliol College) read a paper on liquid crystals, and showed, by microscopic demonstration upon the screen, experiments with para-azoxyanisol and para-azoxyphenetol which melt to doubly refracting liquids at 116° and 135° respectively. These remarkable bodies have not previously been shown in England; the curious transformations which they undergo were made clearly visible to a large audience.

CAMBRIDGE.—A very valuable and interesting collection of Irish antiquities, formed during the last seventy years by Mr. T. R. Murray, of Edenderry, has been acquired for the University by Prof. Ridgeway. It includes unique bronze weapons and ornaments, stone axes and arrowheads, medieval pottery, &c. The collection will be exhibited in the Fitzwilliam Museum on March 5.

A University Prize for the best M.D. Thesis has been founded in memory of Raymond Horton-Smith, M.A., M.B., late scholar of St. John's College, who, after a distinguished career in the University and at St. Thomas's Hospital, London, died last year at the untimely age of twenty-seven. Candidates must have taken honours in one of the Tripos examinations, and the Prize Thesis is to be printed and circulated.

The arrangement with Addenbrooke's Hospital, by which the Professors of Physic and Surgery are to have places on the staff, in consideration of an annual subsidy of 300*l.* from the University, is now submitted for adoption by the Senate. It has already been approved by the Hospital Court, and will probably come into effect forthwith. It puts an end to an old difficulty between the medical school and the hospital.

The thanks of the University are ordered for certain valuable gifts to the Engineering Laboratory. Lord Kelvin has presented a set of apparatus for electrical measurements, Messrs. Siemens Brothers a pair of coupled dynamos, and the Forward Engineering Company a gas engine.

The University Lecturer in Chemical Physiology, Mr. F. G. Hopkins, M.B., London, is to receive the honorary degree of Master of Arts.

THE Senators of Edinburgh University have decided to confer the degree of LL.D. upon Miss Eleanor A. Ormerod, in recognition of her services to entomology.

THE Senators of St. Andrews University have resolved to confer the honorary degree of Doctor of Laws upon Prof. McIntosh, Edinburgh, and Dr. Hugh Robert Mill.

THE Norwich Union Fire Insurance Company have just settled the claim of the West Ham County Borough Council, on account of the damage done in the disastrous fire at the Municipal Technical Institute last October, for the sum of 25,100*l.*, the Council retaining the salvage. This sum is expected to cover completely the cost of the reinstatement. The opportunity will be taken to enlarge the Institute, accommodation having already proved too small for the classes. A new block is to be built to contain the whole of the chemical department. This block will contain two lecture rooms, an advanced and an elementary chemical laboratory, furnace room, combustion room, gas analysis room, balance room, and private laboratory, together with the usual private rooms and store rooms. A small forge and a foundry are to be added to the engineering department. The engine and dynamo laboratory, and the engineering laboratory are both to be enlarged, and extra accommodation will be provided for building-trade classes and for the Women's Department and Art Department, together with several extra class-rooms. The cost of these extensions is estimated at 8000*l.* The builders are busily engaged on the work of reinstatement, and it is fully expected that both new and old portions will be ready for use at the beginning of the new session in October next.

A COPY of an address recently delivered by Sir William White, K.C.B., F.R.S., at the Merchant Venturers' Technical College, Bristol, has been received. In the course of his remarks, Sir William White pointed out that what is wanted from the national point of view is increased individuality and intelligence among the workers engaged in manufactures and industries. A good technical institution provides the means for developing these qualities, and in such a college a student can find help and assistance in trying to obtain a fuller grasp of principles, and a better knowledge of fundamental principles upon which to base his own further efforts. An engineer, whatever his line may be, cannot be completely furnished with the means of carrying on his profession by studying it in the most completely equipped college that could be established; that is only one portion of his education. Until Technical Colleges came into existence, the system of training that was favoured, with